

Master's Thesis project

Thermal analyses of traction batteries using CFD

The primary objective of the proposed master's thesis is to develop a thermal model of a traction battery (batteries used in vehicles) using multi-physics to accommodate for both the physics inside the battery cell as well as around the battery pack.

The use of batteries in cars is a relatively new concept and development within battery cells and the battery pack setup has been accelerating the last few years. Much of the testing and development has been done using virtual testing methods such as CFD. Primarily the cooling of the battery packs has been investigated using virtual methods.

One challenge is to accurately represent the heat transfer between the cell and the surrounding cooling media. This is important to understand how well the cell is utilised as well as how the aging inside the cell is affected. The main problem is to accurately represent the electro-chemical process in the cell, which is dependent on temperature, state-of-charge and the external heat transfer by for example water-cooling.

The project will initially start with building a simplified battery pack using a commercial CFD software and starting with a simplified cell model. This model will be tested against available experimental data to validate the model. The following steps will focus on improving both the accuracy of the external heat transfer as well as the investigating different descriptions of the physical process in the cell. The means of describing the process inside the cell may be to add a commercial battery module to the software or by coding a module using JAVA.

Finally these results will be verified against experimental data in terms of for example aging, temperature and cell performance.

The master's thesis is a cooperation between FS Dynamics Sweden AB and a leading automotive producer.

The system simulation will primarily be performed using the general purpose 3D-software STAR-CCM+ as well as a commercial battery software.

This master's thesis will be conducted at the FS Dynamics office in Gothenburg.

FS Dynamics is a simulation focused and independent consultancy company. We recruit with diversity and equality in mind and our professional consultants provide highly skilled competence within fluid- and structural dynamics analyses.

Ola Dahlin, FS Dynamics

ola.dahlin@fsdynamics.se

031-720 71 53